INTRODUCTION

The enclosed map series focuses on the shoreline habitats, wildlife and human-use resources, and primary methods of spill response for the St. Lawrence River area. It is presented as a supplement to the Joint Canada-United States Marine Pollution Contingency Plan for Spills of Oil and Other Noxious Substances, for the St. Lawrence River. The Marine Pollution Contingency Plan contains additional spill-response information that is not presented on the enclosed maps, particularly with respect to staging sites, disposal areas, river hydraulics, and spill-response personnel. Both the maps and the plan should be consulted during a spill.

ENVIRONMENTAL SENSITIVITY INDEX—ST. LAWRENCE RIVER

SHORELINE TYPES

The shoreline of the study area was classified during fixed-wing and helicopter overflights during September 1983 and November 1984. The Canadian Coast Guard graciously provided the helicopter. Shoreline types are presented primarily on 1:24,000 U.S. Geological Survey topographic maps, but since coverage for the area is incomplete, 1:30,000 U.S. National Ocean Survey charts and 1:50,000 topographic maps from Energy, Mines and Resources Canada were also used. The types of shorelines found within the study area are listed below in order of increasing sensitivity to spilled oil. Environments 9 and 10 are most sensitive and deserve priority protection during a spill incident.

Sensitivity ↓

1. Exposed rocky shorelines (primarily low-lying ledges).
2. Exposed unconsolidated sediment bluffs.
3. Fine-grained sand beaches.
4. Coarse-grained sand beaches.
5. Mixed sand and gravel shores.
6. Gravel shores.
7. Riprap structures.
8. Sheltered rocky shores.
9. Low vegetated banks (with grasses or trees).
10. Wetlands.

(unranked) Harbor structures (concrete, wood, etc.).

BIOLOGICAL RESOURCES

The biological resources found within the St. Lawrence River area are compiled from the literature and from direct contact with scientists knowledgeable about local species occurrence. Areas having these resources should receive consideration when planning all spill-response activities. The symbols used to indicate these resources are indicated below.

BIRDS
- Diving birds
- Gulls and terns
- Raptors
- Shorebirds
- Wading birds
- Waterfowl

FINFISH
- Anadromous fish
- Freshwater fish

MAMMALS
- Aquatic mammals

KEY TO SPECIES

BIRDS

A-Waterfowl
B-Gulls
C-Diving birds

2.	Common snipe	*Capella gallinago*
3.	American woodcock	*Philohala minor*
4.	Great blue heron	*Ardea herodias*
5.	Green heron	*Butorides striatus*
6.	Virginia rail	*Rallus limicola*
7.	Sora rail	*Porzana carolina*
9.	Black-crowned night heron	*Nycticorax nycticorax*
10.	American bittern	*Botaurus lentiginosus*
11.	Belted kingfisher	*Megaceryle alcyon*
12.	Black tern	*Chlidonias niger*
13.	Double-crested cormorant	*Phalacrocorax auritus*
14.	Caspian tern	*Sterna caspia*
15.	Common loon	*Gavia immer*
18.	Mallard	*Anas platyrhynchos*
19.	Black duck	*Anas rubripes*
20.	Green-winged teal	*Anas crecca*
21.	Blue-winged teal	*Anas discors*
22.	Wood duck	*Aix sponsa*
23.	Ring-necked duck	*Aythya collaris*
25.	Greater scaup	*Aythya marila*
26.	Common goldeneye	*Bucephala clangula*
27.	Bufflehead	*Bucephala albeola*
28.	Common merganser	*Mergus merganser*
29.	Bald eagle	*Haliaeetus leucocephalus*
30.	Marsh hawk	*Circus cyaneus*
31.	Osprey	*Pandion haliaetus*
38.	Red-breasted merganser	*Mergus serrator*
39.	Pintail	*Anas acuta*
40.	American coot	*Fulica americana*
41.	Pied-billed grebe	*Podilymbus podiceps*
42.	Common gallinule	*Gallinula chloropus*
46.	Oldsquaw	*Clangula hyemalis*
50.	Great egret	*Casmerodius albus*
52.	Cattle egret	*Bubulcus ibis*
53.	Yellow-crowned night heron	*Nyctanassa violacea*
54.	Yellow rail	*Coturnicops noveboracensis*
55.	Killdeer	*Charadrius vociferus*
56.	Spotted sandpiper	*Actitis macularia*
66.	Herring gull	*Larus argentatus*
67.	Ring-billed gull	*Larus delawarensis*
68.	Common tern	*Sterna hirundo*
69.	Glaucous gull	*Larus hyperboreus*
70.	Great black-backed gull	*Larus marinus*
71.	Least bittern	*Ixobrychus exilis*

FISH

1.	Alewife	*Alosa pseudoharengus*
2.	Rainbow smelt	*Osmerus mordax*
3.	Spottail shiner	*Notropis hudsonius*
5.	Lake trout	*Salvelinus namaycush*
6.	Brown trout	*Salmo trutta*
7.	Rainbow trout	*Salmo gairdneri*
8.	Lake whitefish	*Coregonus clupeaformis*
10.	Coho salmon	*Oncorhynchus kisutch*
11.	Atlantic salmon	*Salmo salar*
12.	Lake sturgeon	*Acipenser fulvescens*
13.	Northern pike	*Esox lucius*
14.	Bluegill	*Lepomis macrochirus*
16.	Black crappie	*Pomoxis nigromaculatus*
17.	Yellow perch	*Perca flavescens*
18.	Largemouth bass	*Micropterus salmoides*
19.	Smallmouth bass	*Micropterus dolomieui*
20.	Rock bass	*Ambloplites rupestris*
22.	Walleye	*Stizostedion vitreum vitreum*
25.	Muskellunge	*Esox masquinongy*
27.	Carp	*Cyprinus carpio*
28.	Gizzard shad	*Dorosoma cepedianum*
29.	Cisco	*Coregonus artedii*
30.	Brook trout	*Salvelinus fontinalis*
31.	Blackchin shiner	*Notropis neterodon*
32.	Blacknose shiner	*Notropis heterolepis*
33.	Fathead minnow	*Pimephales promelas*
34.	Banded killifish	*Fundulus diaphanus*
35.	Shorthead redhorse	*Moxostoma macrolepidotum*
36.	Longnose sucker	*Catostomus catostomus*
37.	White sucker	*Catostomus commersoni*
38.	Yellow bullhead	*Ictalurus natalis*
39.	Brown bullhead	*Ictalurus nebulosus*
40.	Green sunfish	*Lepomis cyanellus*
41.	Grass pickeral	*Esox americanus vermiculatus*
42.	Sauger	*Stizostedion canadense*
43.	Pink salmon	*Oncorhynchus gorbuscha*
44.	Atlantic sturgeon	*Acipenser oxyrhynchus*

MAMMALS

1.	Beaver	*Castor canadensis*
3.	Muskrat	*Ondatra zibethicus*

SOCIOECONOMIC FEATURES

The following information highlights those areas having socioeconomic importance in order to assist or direct the spill-response effort.

- Recreational beaches
- Water intakes (number corresponds to the following list)
- Parks and preserves
- Marinas

ST. LAWRENCE RIVER WATER INTAKES

Name	Phone Number
4. Village of Cape Vincent, U.S.A.	315-654-2474 315-654-2311
5. Burnham Point State Park, U.S.A.	315-782-0100 315-782-4522
6. Cedar Point State Park, U.S.A.	315-782-0100 315-782-4522
7. Ault Foods, Canada	613-382-2178

ST. LAWRENCE RIVER WATER INTAKES (cont'd)

Name	Phone Number
8. Town of Gananoque, Canada	613-382-4555
9. Village of Clayton, U.S.A.	315-686-3332
10. Thousand Island Park, U.S.A.	415-482-2576
11. Grass Point State Park, U.S.A.	315-782-0100 315-782-4522
12. Village of Alexandria Bay, U.S.A.	315-482-9489 315-482-9348
13. Mary Island State Park, U.S.A.	315-782-0100 315-782-4522
14. Kring Point State Park, U.S.A.	315-782-0100 315-782-4522
15. Jacques State Park, U.S.A.	315-782-0100 315-782-4522
16. Private Water Intakes, U.S.A.	Various
17. Village of Morrisburg	315-375-6370 315-375-6703
18. Cow & Gate Ltd., Canada	613-345-1431
19. Phillips Cables Ltd., Canada	613-345-5666
20. Town of Brockville, Canada	613-342-6661
21. Brockville Chemicals, Canada	613-348-3681
22. Dupont Ltd., Canada	613-348-3611
23. Town of Prescott, Canada	613-925-3851
24. City of Ogdensburg, U.S.A.	315-393-0490 315-344-2226
24a. St. Lawrence Pulp & Paper	315-769-2870
25. Canada Starch Co., Canada	613-657-3131
26. Town of Iroquois, Canada	613-652-4422 613-652-4055
27. Town of Morrisburg, Canada	613-543-2504 613-543-3126
28. Town of Ingleside, Canada	613-537-2362
29. Tucker Terrace Water Corp., U.S.A.	315-769-7396
30. Village of Massena, U.S.A.	315-769-8625
30a. Aluminum Co. of America (ALCOA)	315-764-4011
Same as village of Massena	
31. Town of Long Sault, Canada	613-933-1162 613-932-2248
32. City of Cornwall, Canada	613-932-2235
33. Iroquois Chemicals, Canada	613-932-3072
33a. Reynolds Metals Co.	315-764-6000
34. Domtar Fine Papers, Canada	613-932-6620
34a. General Motors Corp. (Central Foundry Div.)	315-764-2000

OIL SPILL RESPONSE

Notations of the locations of boat ramps (for access to the river) and booms and skimmers are included on the maps. The strategy for placing the boom symbols is to indicate localities where booms could protect a sensitive habitat either (a) by diverting oil out into the channel and away from the area or into shore to be collected, or (b) by forming a barrier against the incoming oil. If it is diverted into shore, a collection area must be present. Oil movement is assumed to be downstream, although strong winds can greatly influence movement. Many of the included boom sites are from the St. Lawrence Supplement to the Joint Canada-United States Contingency Plan. Skimmers are assumed to be large, seagoing types commonly using paravanes to channel the oil toward the skimmer. Their placement on the maps is used very sparingly realizing that only a few are presently available. Skimmers are generally positioned in areas where booms would not be effective and where oil would naturally collect.

Boat ramps

Booms

Skimmers

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Please reference as follows: Research Planning Institute, Inc.; 1985; St. Lawrence River supplement to the joint Canada-United States marine pollution contingency plan for spills of oil and other noxious substances; E.R. Gundlach and T.G. Ballou; RPI/ESI/85-9; Columbia, S.C.; 17 maps.

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Description of Shoreline Types

EXPOSED ROCKY SHORES — ESI = 1

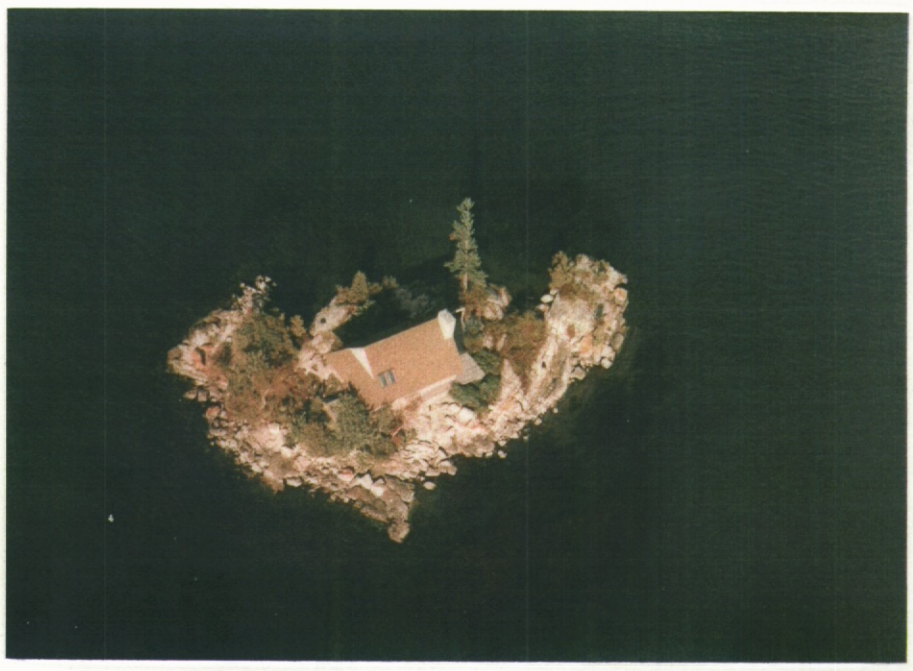
- These rocky shores are exposed to waves and strong currents
- Exposed rocky shores are especially common in the upper portions (bedrock-dominated) of the river (Maps 1-11)
- They are most common as low-lying ledges although some cliffs are present, particularly in the Thousand Island area

Predicted Oil Impact

- Oil will form an oily band on steep shores and may coat large zones of the low-lying rocks
- Oil persistence is related to the incoming wave energy; during high-wave conditions, oil persistence is limited to days
- Birds utilizing these rocky sites may be killed if oiled

Recommended Response Activity

- On most shores, cleanup is of low priority
- Access is usually difficult on steep shores
- Cleanup of recreational areas may be necessary; high-pressure water spraying is effective while oil is still fresh



EXPOSED SEDIMENTARY BLUFFS — ESI = 2

- Exposed sedimentary bluffs are present in the downriver sections where glacial material is present
- They are composed of soft, unconsolidated sediments
- These bluffs may be over 25 feet (8 m) high
- Beaches in front of the bluffs are narrow or absent
- Biological activity is low

Predicted Oil Impact

- Incoming oil will form a band along the high-tide swash line
- Oil persistence is limited to days or weeks, due to wave activity

Recommended Response Activity

- In most areas, cleanup is not necessary due to the short residence time of the oil
- Oil can usually be scraped off the surface of the sediment using manual labor
- Removal of sediment should be avoided
- Mechanical cleanup may be very difficult due to the steep slope of the bluff

FINE-GRAINED SAND BEACHES — ESI = 3

- Fine-grained sand beaches are not common in the study site
- They generally occur as small pocket beaches downriver
- These beaches usually contain a broad, gently sloping profile
- They often are used as recreational beaches

Predicted Oil Impact

- Light oil accumulations will be deposited as oily swashes along the upper beach
- Oil penetration into the beach will be limited
- Shorebirds may be killed if oiled

Recommended Response Activity

- Fine-grained sand beaches are among the easiest beach types to clean
- Cleanup should concentrate on the removal of oil from the upper swash zone
- Removal of sand from the beach should be minimal to avoid erosion problems; special caution is necessary in areas backed by seawalls
- Activity through both oiled and dune areas should be severely limited
- Manual cleanup rather than use of road graders and front-end loaders is advised

COARSE-GRAINED SAND BEACHES ESI = 4

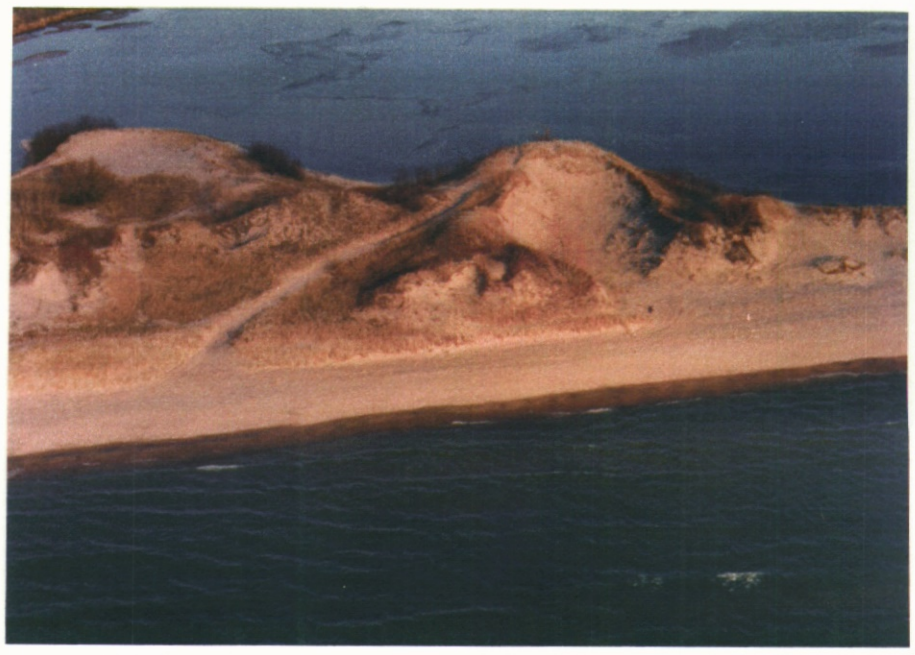
- Coarse-grained sand beaches are not particularly common within the study area
- These beaches usually have a moderate slope and may contain gravel
- They are present as beaches approximately 200 meters long
- They may be present as small pocket beaches or as sand tombolo

Predicted Oil Impact

- Commonly, oil will be deposited on and become mixed into the sand along the swash zone
- Oil may also penetrate (or seep) deeply into the beach

Recommended Response Activity

- Cleanup may be difficult because of relatively soft sediments
- Cleanup should concentrate on oil removal from the upper swash zone
- Sand removal should be minimal to avoid erosion problems
- Activity through the oiled sand should be limited to prevent grinding oil deeper into the beach
- Use of heavy equipment for oil/sand removal may result in the removal of excessive amounts of sand; manual cleanup may be more efficient



MIXED SAND AND GRAVEL BEACHES ESI = 5

- Mixed sand and gravel beaches are common along short segments of shore where sediments are available from behind the beaches
- Beach access is generally good

Predicted Oil Impact

- Oil will be deposited primarily along the swash zone
- Oil percolation into the beach may be deep, particularly in well-sorted material
- Very common throughout the study area, particularly the downriver portions (Maps 11-19)
- Has glacial material as a sediment source
- Sometimes present in front of eroding sedimentary bluffs, depending on water level
- Biota present may be killed by the oil, either by smothering or by lethal concentrations in the water column

Recommended Response Activity

- Removal of sediment should be limited
- Mechanical reworking of the sediment into the wave zone and/or high-pressure water spraying can effectively remove the oil; sorbent boom may be necessary to capture oil outflow

GRAVEL BEACHES ESI = 6

- Gravel beaches are fairly common within the study site, particularly along the downriver portions of the river
- They are especially prevalent where waves or currents are able to winnow out the finer sediments, as along sedimentary headlands

Predicted Oil Impact

- The primary problem with oil pollution in this environment is related to the deep penetration of oil into the gravel beach
- If oil is left uncleaned, it may become asphalt-like
- Resident fauna and flora may be killed by the oil

Recommended Response Activity

- Removal of sediment should be restricted
- The use of high-pressure water spraying may be effective at removing oil while it is still fresh
- Sorbent booms or pads should be used to capture oil outflowing during the cleansing process

RIPRAP STRUCTURES — ESI = 7

- Riprap structures are scattered throughout the region, primarily for shore protection and breakwaters
- They are composed of cobble- to boulder-sized material
- Biota along the upper structures are sparse, although gulls may be common
- Some fish occupy portions of the riprap structures
- Riprap is an important substrate for fish-food organisms and for the spawning of several species of fish

Predicted Oil Impact

- Oil would percolate easily between the gravel and boulders of riprap structures
- Biota would be damaged or killed under heavy accumulations

Recommended Response Activity

- Along exposed structures, cleanup may not be necessary
- May require high-pressure spraying:
  - -to remove oil
  - -to prepare substrate for recolonization of barnacle and oyster communities
  - -for aesthetic reasons
- Since riprap is often associated with developed, recreational beaches, cleanup would be advisable to minimize chronic leaching of oil trapped in the rocks

SHELTERED ROCKY SHORES — ESI = 8

- Sheltered rocky shores are composed of bedrock ledges or cliffs
- These shores are located in calm, interior environments
- They are most common in the Thousand Island area

Predicted Oil Impact

- Oil in heavy quantities may persist for several years especially between rocks
- Light oiling will appear as an oily band

Recommended Response Activity

- These are areas needing priority protection using deflection booms, sorbent booms, and offshore skimmers
- High- and low-pressure water spraying may be effective while oil is still fresh

LOW BANKS SUBJECT TO FLOODING — ESI = 9

- Low banks subject to flooding are very uncommon in the study area
- Either low banks with grasses or low, eroding banks with trees and tree roots exposed to the water are present
- They are primarily found in the Thousand Island area
- Typically, the area covers less than a hundred meters of shoreline

Predicted Oil Impact

- During low river stages, oil will coat only the edge of the bank or the exposed tree roots
- During high river stages, oil can overtop the bank and cover the grasses or trees on the bank
- Oil may kill the grasses and other vegetation present
- Trees may become oiled, but probably not be killed unless oil concentrations within the base sediments are very high

Recommended Response Activity

- Where possible, these areas should be boomed to prevent oil from entering
- Raking oiled grasses may effectively remove light-to-moderate oil accumulations
- High- and low-pressure spraying, with cutting only if necessary, will aid oil removal from exposed tree roots
- Sorbent booms should be placed on the waterside of the cleanup operation to collect outflowing oil

WETLANDS ESI = 10

- This type is most commonly present as a fringing wetland
- Sheltered embayments such as Chipewa Bay and behind Grenadier Island contain broad wetlands
- Wetlands are relatively sheltered from wave activity
- They are composed of emergent or floating aquatic vegetation
- Wetlands are the most important wildlife habitat in the area, providing a nesting area for ducks, geese, herons, rails, kingfishers, some shorebirds, muskrats, and turtles; as well as a major nursery and spawning ground for many species of sport and forage fish
- Several rare plants are also found

Predicted Oil Impact

- Oil in heavy accumulations may persist for decades
- Small quantities of oil will be deposited primarily along the outer wetland fringe or along the upper wrack (debris) swash line
- Resident biota, including bird life, are likely to be oiled and possibly killed

Recommended Response Activity

- Under light oiling, the best practice is to let the wetland recover naturally
- During winter months, surface ice commonly offers shoreline protection
- Cutting of oiled grasses and low-pressure water spraying are effective, especially during the early part of the spring growing season
- Heavy oil accumulations on the wetland surface should be removed manually; access across the wetland should be greatly restricted
- Cleanup activities should be carefully supervised to avoid excessive damage to the area

HARBOR STRUCTURES (NOT RANKED)

- These structures are common for shoreline protection, particularly in harbor areas and around hydroelectric stations and locks
- They are composed of solid concrete, wooden, or metal bulkheads, and wooden pilings
- Birds may be common along upper portions of the structure

Predicted Oil Impact

- Oil tends to coat the solid structure
- Oil persistence is minimal along the structures exposed to wave action; persistence is long term in sheltered areas

Recommended Response Activity

- Along exposed structures, cleanup may not be necessary
- High-pressure spraying or sandblasting is effective, especially for fresh oils
- Cleanup is usually necessary in recreational beach areas; sorbent materials should be used to capture the oil as it leaches out